Exploring and Examining the Public Sense of Gain on YB Conservation and Development based on CSS2019

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Abstract: Ecological conservation and high-quality development of the Yellow River Basin (abbreviated to YB Conservation and Development) has just been established as another major national strategies of China, and the public sense of gain (PSG) has been generally accepted as the benchmark and standard of good governance in China New Time. This paper explored to construct the logical principles and transmission mechanisms of the PSG and YB conservation and development, suggested to take the PSG as a better regulations and guidances for the sound development of the Yellow River Basin. Based on the data of Chinese Social Survey in 2019 (CSS2019), this paper tried to exam the PSG on YB Conservation and Development at the beginning of the national strategy. An evaluation index system including 5 factor dimensions and 25 evaluation indices was constructed, and the consistent processed methods of the raw data in CSS2019 were developed. After that, the normal distribution of continuous distribution was used to describe the survey data, and the dominance matrix method was applied to make decision based on PROMETHEE Ⅱ. The empirical results indicated that the PSG of the middle and upper reaches of the Yellow River is lower than the overall level of China, and the public in the Yellow River Basin were generally satisfied with government public services and social civilizations, except economic situations, living environment and individual self-fulfillments. Accordingly, some pertinent suggestions were put forward and some plans for further research were also explained.

Keywords: public sense of gain; the Yellow River Basin; YB Conservation and Development; uncertainty decision-making; CSS2019

1. Introduction

The Yellow River Basin is one of the important ecological barriers and economic zones, also the important breadbaskets and energy bases in China [1]. The Yellow River Basin plays overall, strategic and fundamental roles in maintaining food security, energy security and ecological security, and it also plays great roles in ensuring national and regional sustainable development [2-3]. Meanwhile, the Yellow River is a rebellious disaster river. Since ancient times, frequent ice disaster, floods and droughts have brought serious disasters to the people along the river [4-7]. Since the founding of new China, breakthroughs have been made in conservation and harness of the ecological environment in the Yellow River Basin. However, there are still some serious problems badly in need of solutions under the influences of global climate changes and human activities. For example, its ecological environment is still badly fragility, its water scarcity is getting worse, and its economic and social development is still relatively backward in general and so on [8-11]. Therefore, it has become a major challenge for Chinese government and people to further promote the harmonious development between protection and exploitation of the Yellow River [12]. Under such background, Chinese President Xi Jinping hosted a forum on “ecological conservation and high-quality development of the Yellow River Basin” (Hereinafter referred to as “YB Conservation and Development”) in Zhengzhou on September 18, 2019 and delivered an important speech. At this forum, Xi Jinping pointed out that the protection of the Yellow River is a significant deployment for the great rejuvenation and sustainable development of the Chinese nation, he stressed that Chinese people should work together to protect and harness the Yellow River, and he issued a call "to make the Yellow

River a happy river to benefit the local residents". Since then, YB Conservation and Development has been upgraded as another major national strategy of China [13]. The existing researches on YB Conservation and Development mainly includes two aspects, one is to interpret, understand, experience and reflect on this Chinese major strategy [14-15], the other is to contribute intelligences and suggestions for implementing this Chinese major strategy [1, 16]. For example, Liu et al. [17] took provincial region as research unit to evaluate the coupling coordination degree and the interactive response relationship between ecological protection and high-quality development in the Yellow River Basin; Under the guidance of important ideas such as sustainable development, harmony between humans and water and ecological civilization, Zuo et al. [18] constructed a research framework for selecting high-quality development path in the Henan section of the Yellow River Basin; Wang and Miao [19] organized an album on high-quality development of the Yellow River basin published in the Journal of Natural Resources, aimed at providing suggestions for the practice of urban-rural coordination, ecological protection, resource allocation, economic development and cultural inheritance in the Yellow River Basin. On the whole, the local governments at all levels, scholars and all walks of life in the Yellow River Basin are currently working together and striving to protect and harness the Yellow River and improve the quality of regional economic and social development.

Public sense of gain (hereinafter referred to as PSG), a brand new concept put forward by Chinese President Xi Jinping for the first time on February 27, 2015, has been generally accepted as the goal of reform and development in Chinese new era, and as the benchmark and standard of good governance in Chinese new era [20]. The new concept fully reflects the new changings and demands of Chinese people's yearning for their better life, and it has soon become one of the hot issues in various fields, the researchers have also been developing a lot of theoretical discussions and qualitative analysis around this concept [21]. Based on the empirical analysis of three ancient towns in Shanghai, Huang et al. [22] studied the evaluation and influence mechanism of rural development of ancient towns. Zhang and Liu [23] used the data of China's general social survey (CGSS) to measure the PSG on participation in basic medical insurance. Wen and Liu [24] researched the trends and disparities empirical analysis of the PSG based on Chinese urban and rural social governance dada. Wang et al. [25] researched on the factors of poverty subjects' acquired sense under the background of E-commerce poverty alleviation. Huang [26] explored the influential factors and boosting approaches of ecological sense of gain based on the essence of the sense of gain. Wang et al. [27] explored the mediating effect of community identity between socioeconomic status and sense of gain in Chinese adults by analyzing nationally representative samples of 28,300 adults from the China Family Panel Studies. Zuo et al. [28] took the Happy River Index (HRI) as an integrated index of river health and human well-being and established an HRI assessment framework for the Yellow River Basin. Besides, some researchers payed close attentions to the macro mechanism, evaluation system and evaluation methods of PSG [21, 29-32]. However, for the concept of PSG, there have yet no consistent methods currently on scientific quantitative research, comprehensive mechanism investigation and temporal and spatial changes analysis. Especially, there are few published research achievements about the PSG on YB conservation and development at present.

Consequently, it is timely and required to take the PSG as the general benchmark and standard to guide the strategy implementations and to measure the development achievements of YB Conservation and Development. Considering the PSG is an important macroscopic indicator to measure the good national governance, it is necessary to obtain and describe the subjective psychological cognitive information of the public from all walks of life, and analyze the main influencing factors and spatiotemporal evolution modes of the PSG on the provincial level or a larger regional. Based on this research framework, the research conclusions can not only provide decision bases and policy references for provincial governances on YB Conservation and Development, but in the sense of social science, it can also form panel data to analyze and judge the causal connotation, which is more valuable than cross-sectional data at the individual level. This research attempts to construct the logical structure of the PSG and YB conservation and development, explore their logical principles and transmission mechanisms, and then make a preliminary empirical study to exam the PSG in the Yellow River Basin at the beginning of this Chinese strategy.

The rest of this paper is arranged as follows. Section 2 explores and explains the logical relationship of the PSG and YB conservation and development; And accordingly, section 3 tries to develop a

hierarchical index system and carry out an empirical study in the Yellow River Basin based on the data of Chinese Social Survey in 2019 (hereinafter referred to as CSS2019) to exam the PSG on YB conservation and development at the beginning of this Chinese strategy, and then put forward some pertinent suggestions. Concluding remarks are mentioned in Section 4.

2. The logical relationship of the PSG and YB conservation and development

Sense of gain is a much localized concept of China, it should be understood from the background of China in the New Time, including expanded in-depth reform agenda, changing economic and social development modes, and realizing shared development and so on [33]. There is no complete consensus currently on the specific definition and theoretical connotation of the PSG, but more positively, a growing number of scholars and researchers accept that the PSG should be selected as the most appropriate criteria to measure the effectiveness of Chinese government reform and governance [20]. They generally agree with the following standpoints:

(1) The PSG is a positive subjective feeling of the general public after their actual gains, and there are significant differences in the PSG among the social groups of different characteristics;

(2) The measurement and improvement of the PSG should take into account the following factor dimensions, such as the objective benefits and subjective feelings in the individual psychological dimension, the unbalanced distribution of group mood in the social groups dimension, and the dynamic variability because of policy implementation in the time dimension;

(3) The PSG should be considered from the macro socio-economic and political process of a country or region; it can be divided into dominant sense of gain and recessive sense of gain, where the dominant sense of gain includes income, medical insurance, education and pensions and so on, and the recessive sense of gain includes fairness and justice, democracy, civilization and value recognition and so on.

(4) The research on PSG should pay special attention to the investigation and improvement of the sense of gain of the underprivileged groups and ordinary people, so as to reflect the obvious "bottom" consciousness of national governance and the essential meanings of this brand-new concept.

Accordingly, the PSG on YB conservation and development can be specifically defined. In a certain period since the national major strategy of YB conservation and development has been implemented, the PSG represents the further subjective psychological welfare increment generated by the local general public, after they obtain material, health or psychological welfare effectively from the process of ecological protection and harness and economic high-quality development. According to this definition, the essential connotation of the PSG is the subjective psychological welfare including high economic and social properties, high comparison properties and high dynamic characteristics [21]. This paper attempts to develop a logical structure diagram of the PSG and YB conservation and development (see Figure 1).

Figure1 tries to reflect the logic relationship and transmission mechanism of YB conservation and development. The influences of this Chinese strategy on the economic and social development of the Yellow River Basin are extensive and far-reaching, including various aspects such as economic development, governmental services, ecological civilization and people's livelihood and so on, thus it is difficult to measure all the subjective and objective changes with indicators alone. Just as Xi Jinping said, the general goal of YB conservation and development is to make the Yellow River a happy river for the people, and all work should follow these principles such as to make people's life better, people-centered and to work for people's general happiness and so on. Thus all of our work, whether the ecological conservation and harness of the Yellow River Basin or the high-quality development of the Yellow River Basin, will return to the work of people-oriented, which is attributed to the cognitions and feelings of the general public in the Yellow River Basin. Consequently, it is scientific and reasonable to take PSG as evaluation standard and build the corresponding evaluation system to measure the achievements of the YB conservation and development.

Besides, the logical structure diagram is highly accords with the general goal of "Happy River", which was determined by Ministry of Water Conservancy of China, including flood control and safety protection, high quality water resources, healthy water ecology, livable water environment and advanced water culture [15, 34]. The measurement system of high-quality development level of the Yellow River Basin has not yet officially released, and the researches are still in its infancy. But according to the existing literatures [8-9, 18, 35-36], the achievements of high-quality development of the Yellow River Basin

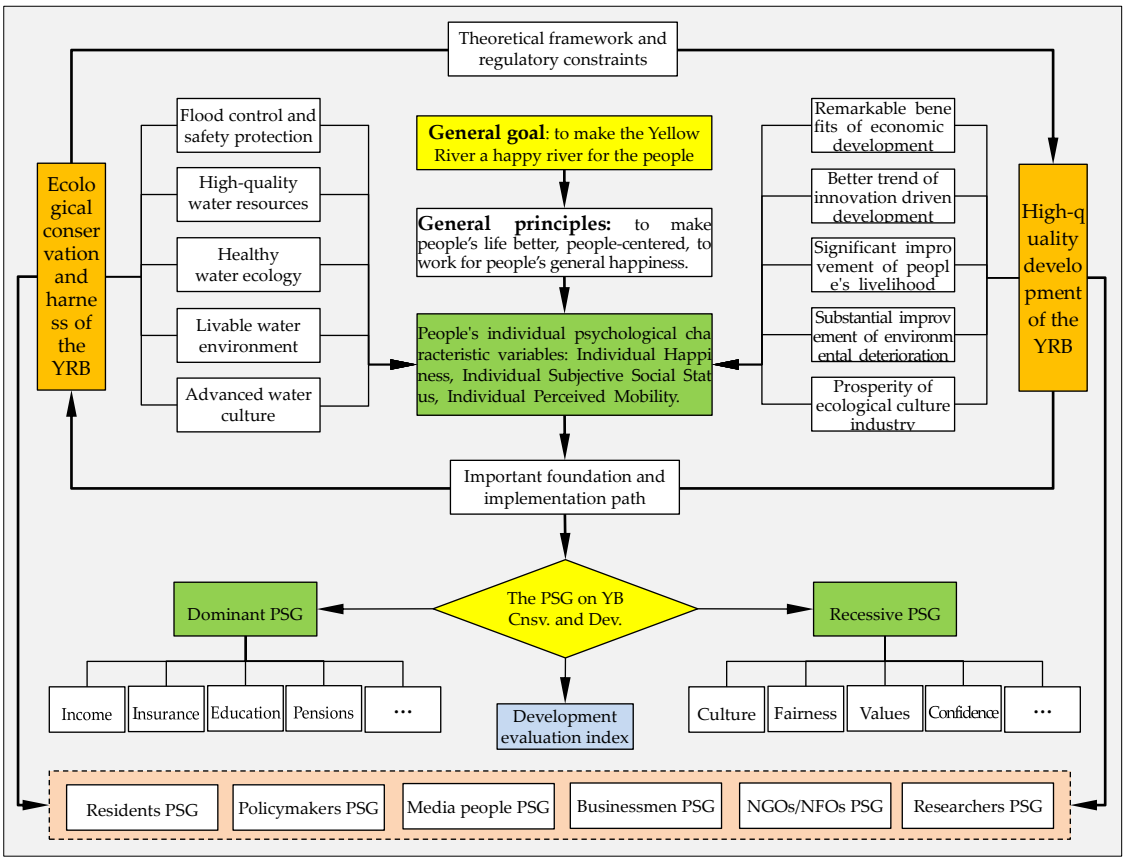

Figure1. The logical structure diagram of the PSG and YB conservation and development

should be evaluated from the following five aspects at least: (1) Remarkable benefits of economic development; (2) Better trend of innovation driven development; (3) Significant improvement of people's livelihood; (4) Substantial improvement of environmental deterioration; (5) Prosperity of ecological culture industry. They basically coincide with the connotation and strategic direction of high-quality development of the Yellow River Basin.

The logic relationship of high-quality development and ecological conservation and harness of the Yellow River Basin is dialectical unity [8]. Ecological conservation and harness of the Yellow River Basin can provide theoretical framework and regulatory constraints for high-quality development of the Yellow River Basin, and ensure its sustainable development; meanwhile, without the important foundation of high-quality development of the Yellow River Basin, ecological conservation and harness of the Yellow River Basin cannot be carried out smoothly. A scientific and reasonable evaluation system of the PSG on YB conservation and development can not only carry out the necessary regulatory constraints, but also provide direction and ideas for YB conservation and development. Therefore, the investigation and examining of PSG on YB conservation and development should cover a wider public in the Yellow River Basin, including the local ordinary residents, the policymakers in government, the media workers, the businessmen, the scholars and researchers, and the non-governmental organizations (NGOs)/ non-profit organizations (NFOs)/community-based organizations (CBOs) and so on. Therefore, it is necessary to carry out large-scale social surveys regularly and continuously to obtain the fundamental data of the PSG on YB conservation and development.

Fortunately, since 2006, Chinese Academy of Social Sciences (CASS) has established Chinese social quality data archive and regularly opened Chinese social survey data to the public. These data are collected in strict accordance with the sampling survey rules and cover a wide range of China, and the data involve the employment status, social lives and attitudes of the public across China. Thus the Chinese social survey (CSS) data can be used as important references to carry out this research. As a tentative research, the social survey data of CSS2019, which was released free of charge by CASS to the

whole society at the end of December 2020[①], will be used in this paper to exam the PSG on YB conservation and development at the beginning of the national strategy.

3. Empirical study of the PSG on YB conservation and development

3.1 Description of the study area

From the perspective of natural geographical boundaries, the Yellow River has a total length 5464*km*, it flows through 9 provinces of China, including Qinghai, Sichuan, Gansu, Ningxia, Inner Mongolia, Shanxi, Shaanxi, Henan and Shandong, with a drainage area of 795000km^2 (including the inner drainage area of 42000 km^2), and the Yellow River Basin involves 71 prefecture-level cities of the above 9 provinces and 1 county-level city directly under the provincial government [37-38].

It should be noted that, there are 91 prefecture-level cities covered in the Chinese major strategy of YB Conservation and Development, including all regions of the following 7 provinces such as Qinghai, Gansu, Ningxia, Shanxi, Shaanxi, Henan and Shandong, and 6 cities and 1 county in western Inner Mongolia and 2 autonomous prefectures in northwest Sichuan [1], see Figure 2.

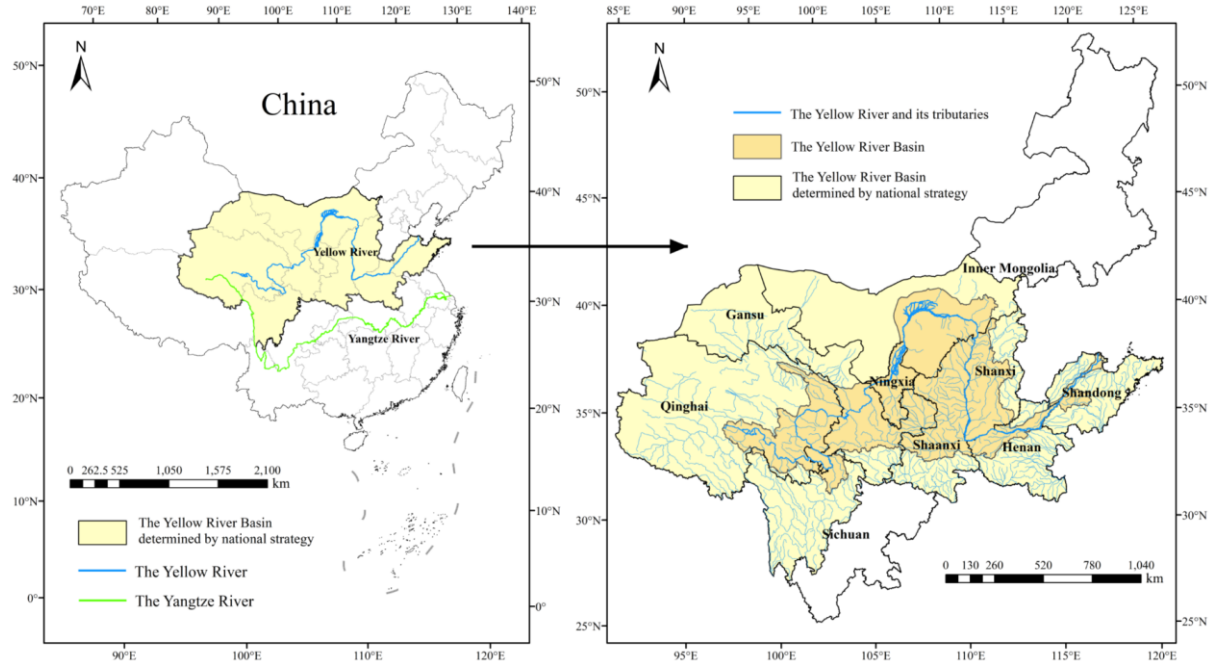

Figure2. The boundary of the Yellow River Basin determined by the Chinses strategy

From the perspective of economic and social development, the Yellow River Basin has the total population of 324 million, accounting for 23.31% of the total population of China in 2019, having an average population density of 408 persons per square kilometer; the Yellow River Basin has the gross domestic product (GDP) of 19.4 trillion yuan, accounting for 21.55% of the total national GDP of China in 2018, having per capita GDP of 59.88 thousand yuan. Among them, the total population of Henan Province and Shandong Province in the lower reaches of the Yellow River accounts for 60.62% of the total population of the Yellow River Basin in 2019, and they also contributed 64.19% of the GDP of the Yellow River Basin in 2018. However, the general economic and social development situation of the Yellow River Basin lags behind the situation of the whole country, and the gap between its macro-economic development level and that of the whole country has a downward trend [1].

3.2 Source of data

CSS2019 is the latest issue of cross-sectional data published so far, it has collected 10283 valid questionnaires from more than 11000 urban and rural families in 149 cities (counties and districts) of 31 provinces (autonomous regions and province-level municipality). The research topics of CSS2019 is social

[①] Data sources: Chinese social quality data archive, http://csqr.cass.cn/index.jsp, 2020.12.30.

quality and social class change, and its survey covers family employment, economic status, living conditions, social security social values and social evaluation, social participation and social evaluation, social participation and political participation, voluntary service and so on. According to the previous analysis, the survey topics and contents of CSS2019 are consistent with this study, so its raw data can be used for empirical analysis. However, there are great differences of the survey frequency in the main provinces of the Yellow River Basin in CSS2019. The survey frequency in CSS2019 and some statistical data of economic and social development of seven provinces in the Yellow River Basin are listed and shown in Table 1 and Figure 3.

Table1. The comparisons of survey frequency and economic social conditions in the Yellow River Basin[②]

The divisions of the Yellow River Basin	The middle and upper reaches of the Yellow River(A_1)					Henan (A_2)	Shandong (A_3)	China (A_c)
	Qinghai	Gansu	Ningxia	Shaanxi	Shanxi			
The survey frequency in CSS2019	55	147	32 676	236	206	672	595	10283
The GDP in 2019/100 million yuan	2965.95	8178.30	3748.48 57712.58	25793.17	17026.68	54259.20	71067.53	990865.1
The year-end population in 2019 /10 thousand people	554	2551	618 10852	3718	3411	9429	9417	140005
The PCDI in 2019 /Yuan	22617.7	19139.0	24411.9	24666.3	23828.5	23902.7	31597.0	30732.8
The CONSP in 2019/Yuan	17544.8	15879.1	18296.8	17544.8	15862.2	16331.8	20427.5	21558.9

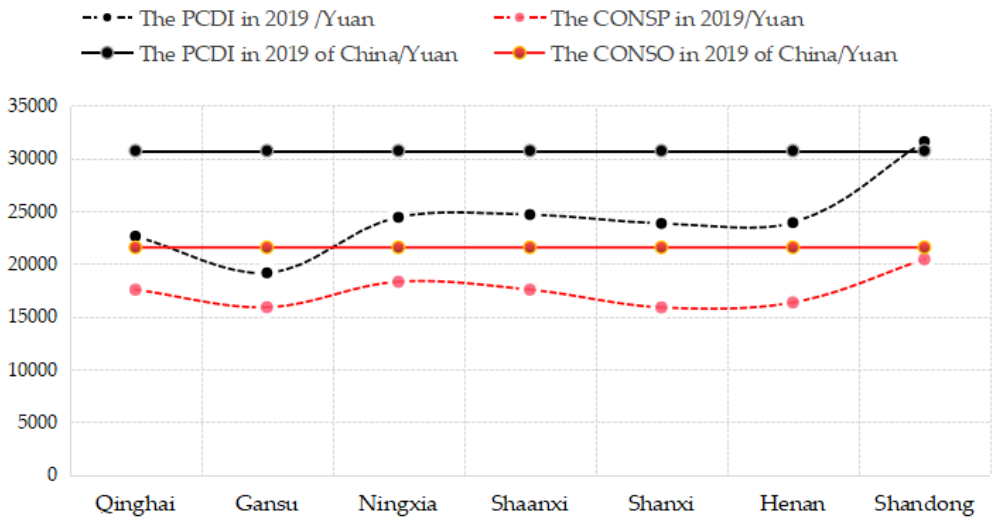

Figure3. The comparisons of PCDI and CONSP in 2019 of 7 provinces in the Yellow River Basin

It can be seen from Table 1 that the sum of survey frequencies of 5 provinces in the middle and upper reaches of the Yellow River is nearly the same as the survey frequency of Henan province and Shandong province in CSS2019. Similarly, the sum of both the GDP and year-end population of these 5 provinces are very close to both the GDP and year-end population of Henan and Shandong. And from Figure 3 and Table 1, the Per Capita Disposable Income (PCDI) and the Per Capita Consumption Expenditure (CONSP), which can be used to measure the living conditions of people in a region, have little differences in their statistical data of the 7 provinces, and they are both listed below the Chinese average (except the PCDI data of Shandong province).

Therefore, in order to ensure the regional integrity and the survey frequency balanced according to CSS2019, this paper divided the Yellow River Basin into 3 parts: the middle and upper reaches of the Yellow River, Henan Province and Shandong Province, where the middle and upper reaches of the Yellow River includes 5 provinces (autonomous regions) of Qinghai, Gansu, Ningxia, Shaanxi and Shanxi. The rest regions of this Chinese major strategy of YB Conservation and Development, including 9 cities (county or autonomous prefectures) in northwest Sichuan and western Inner Mongolia (see Figure 2), are not considered in this paper.

② Data sources: China Statistical Yearbook 2020, http://www.stats.gov.cn/tjsj/ndsj/2020/indexch.htm, 2020.12.30.

3.3 Evaluation index system

Under the framework of this Chinese major strategy and the logical structure of its PSG (Figure 1), this research selects the influencing factors of the PSG on YB Conservation and Development based on the questionnaire published by CSS2019, literature analysis and on-site interviews, and ensures the consistency of selected evaluation indexes through repeated argumentation by experts. Finally, the evaluation index system of the PSG on YB conservation and development, including 5 factor dimensions and 25 evaluation indices, is constructed for empirical analysis, and the index weight is also determined according to the AHP method, as shown in Table 2.

(1) The PSG on economic situations of individual and family (E). This factor dimension mainly investigates the satisfaction and subjective feelings of the respondents due to the improvement of family and individual income, economic situations and socio-economic level. There are 5 indices selected such as socio-economic level at present (E_1), socio-economic level five years ago (E_2), conditions of household income and expenditure (E_3), satisfaction with family's economic situation (E_4) and satisfaction with current life (E_5).

(2) The PSG on living environment (L). This factor dimension mainly examines the subjective feelings and evaluations of the respondents due to the improvement of the living environment and the positive efforts made by local government to improve the environment. There are 5 indices selected such as Air pollution (L_1), Water pollution (L_2), Noise pollution (L_3), The other pollution including land pollution, electromagnetic ionizing radiation pollution etc. (L_4), Work for protection and harness the living environment by local government (L_5).

(3) The PSG on government public services (G). This factor dimension mainly reflects the subjective feelings and recognition of the masses of the people on the quality of public services based on the adequacy, convenience and balance of public services provided by the government, including 6 indices as follows: Basic social securities (G_1) such as pension, medical care, employment, subsistence allowances and basic security housing and so on, Cracking down on crimes and maintaining public order (G_2), Developing economy and increasing people's income(G_3), Enthusiasm and effect of serving the people(G_4), Providing high quality educational resources and ensuring educational equity(G_5), and Ensuring food and drug safety(G_6).

(4) The PSG on social civilizations (S). This factor dimension mainly researches the evaluation and recognition degree of the general public on the promotion of the overall civilization of the society due to the high-quality development of the economy, including 5 indices as follows: the Social trust level (S_1) between people; the Social tolerance degree (S_2) on the group of beggars, AIDS patients, homosexuals etc.; the Social equity level (S_3) about distribution of wealth, judicatory and administrative execution, public health care, job opportunities and political rights etc.; the Modern citizen morals level (S_4) of the general public; and the Observe law and discipline level (S_5) of the general public.

(5) The PSG on people's individual self-fulfillments (I). This factor dimension mainly studies the mental experiences emotional satisfaction of people's individual self-efficiency, development opportunities and development capabilities. There are 4 indices selected such as Current job satisfaction degree (I_1), Life reality fits the ideal (I_2), Believing that the God will always reward the diligent (I_3) and Socio-economic level in next 5 years (I_4).

3.4 Evaluation methods

(1) Data preprocessing. In the raw database of CSS2019, the data of some indices are missing, overflowing the routine evaluation criteria (e g. "-8 Unclear", "98-Unclear"), and the evaluation criteria of some indices are inconsistent, for example, 1-10 scale, 1-5 scale, and 1-4 scale. In addition, the polarity definitions of some evaluation indices are also inconsistent, for example, the score "1" means "Upper-class" or "Very good" when indicating one's local socio-economic level or one's evaluation on ensuring food and drug safety by local government, but the score "1" means "very dissatisfied" when indicating one's overall satisfaction degree with his/her current life. Therefore, in order to build the unified evaluation methods, this paper designs the following principles to preprocess the raw data of CSS 2019 of the study area.

Table2. The evaluation index system of the PSG on YB conservation and development

Factor dimensions	Evaluation indices	Index description and quantitative assignment in CSS2019	Index weight
Economic situations (E, 0.4534)	Socio-economic level at present (E_1)	What is your local socio-economic level at present? 1- Upper-class; 2-Upper middle; 3-Middle; 4-Lower middle; 5-Underclass; 8- Unclear.	0.0646
	Socio-economic level 5 years ago (E_2)	What is your local socio-economic level five years ago? 1- Upper-class; 2-Upper middle; 3-Middle; 4-Lower middle; 5-Underclass; 8- Unclear.	0.0338
	Conditions of household income and expenditure (E_3)	How was your family's overall income and expenditure last year (2018)? 1- Income over spending; 2- Income and expenditure balance; 3- Income less than expenditure; 8- Unclear.	0.1401
	Satisfaction with family's economic situation (E_4)	What is your satisfaction degree with your family's economic situation? 10-point system, in which 1 means very dissatisfied and 10 means very satisfied.	0.2415
	Satisfaction with current life (E_5)	What is your overall satisfaction degree with current life? 10-point system, in which 1 means very dissatisfied and 10 means very satisfied.	0.5200
Living environment (L, 0.2059)	Air pollution (L_1)	How serious is the air pollution in your residential areas? 1- More serious; 2- Serious; 3- Less serious; 4-Nothing serious; 8- Unclear.	0.1590
	Water pollution (L_2)	How serious is the water pollution in your residential areas? 1- More serious; 2- Serious; 3- Less serious; 4-Nothing serious; 8- Unclear.	0.2601
	Noise pollution (L_3)	How serious is the noise pollution in your residential areas? 1- More serious; 2- Serious; 3- Less serious; 4-Nothing serious; 8- Unclear.	0.0745
	Other pollution (L_4)	How serious is the land pollution, electromagnetic ionizing radiation pollution etc. in your residential areas? 1- More serious; 2- Serious; 3- Less serious; 4-Nothing serious; 8- Unclear.	0.0369
	Work of protection and harness (L_5)	What is your evaluation on environmental protection and harness by local government? 1- Very good; 2- Good; 3- Bad; 4- Very bad; 8- Unclear.	0.4695
Government public services (G, 0.1025)	Basic social securities (G_1)	What is your satisfaction degree on the basic social securities provided by local government, such as pension, medical care, employment, subsistence allowances and basic security housing, etc.? 10-point system, in which 1 means very dissatisfied, 10 means very satisfied and 98 means unclear.	0.1835
	Maintaining public order(G_2)	What is your evaluation on cracking down on crimes and maintaining public order by local government? 1- Very good; 2- Good; 3- Bad; 4- Very bad; 8- Unclear.	0.4226
	Increasing people's income(G_3)	What is your evaluation on increasing people's income by local government? 1- Very good; 2- Good; 3- Bad; 4- Very bad; 8- Unclear.	0.2302
	Serving the people(G_4)	What is your evaluation on serving the people by local government? 1- Very good; 2- Good; 3- Bad; 4- Very bad; 8- Unclear.	0.0400
	Ensuring educational equity(G_5)	What is your evaluation on ensuring educational equity by local government? 1- Very good; 2- Good; 3- Bad; 4- Very bad; 8- Unclear.	0.0276
	Ensuring food and drug safety(G_6)	What is your evaluation on ensuring food and drug safety by local government? 1- Very good; 2- Good; 3- Bad; 4- Very bad; 8- Unclear.	0.0960
Social civilizations (S, 0.0433)	Social trust level (S_1)	What is your evaluation on the trust level between people? 10-point system, in which 1 means very distrust and 10 means very trust.	0.0659
	Social tolerance degree (S_2)	What is your evaluation on the social tolerance degree? 10-point system, in which 1 means very intolerant and 10 means very tolerant.	0.0515
	Social equity level (S_3)	What is your evaluation on the social equity level? 10-point system, in which 1 means very unfair and 10 means very fair.	0.1095
	Modern citizen morals level (S_4)	What is your evaluation on modern citizen morals level? 10-point system, in which 1 means very bad and 10 means very good.	0.2369
	Observe law and discipline (S_5)	What is your evaluation on the level of observe law and discipline? 10-point system, in which 1 means very bad and 10 means very good.	0.5362
Individual self-fulfillments (I, 0.1949)	Current job satisfaction degree (I_1)	What is your satisfaction degree on your current job? 10-point system, in which 1 means very dissatisfied, 10 means very satisfied and 98 means unclear.	0.1511
	Life reality fits the ideal (I_2)	Do you agree with the statement that "my life is roughly in line with my ideal"? 1- Strongly agree; 2- Basically agreed; 3- Partially disagree; 4- Strongly disagree; 8- Unclear.	0.0757
	Believing that the God will always reward the diligent (I_3)	Do you agree with the statement that "the God will always reward the diligent?" 1- Strongly agree; 2- Basically agreed; 3- Partially disagree; 4- Strongly disagree; 8- Unclear.	0.3014
	Socio-economic level in next 5 years (I_4)	What is your local socio-economic level in the next 5 years? 1- Upper-class; 2-Upper middle; 3-Middle; 4-Lower middle; 5-Underclass; 8- Unclear.	0.4718

a. Imputing missing data. If the missing data of an index accounts for less than 10% of the total survey, the missing data will be imputed according to the moderate (or median) value of its evaluation scale, for example 6 of 1-10 scale, 3 of 1-5 scale etc. If the missing data of an index accounts for more than 90% of the total survey, this index should be removed from the evaluation index system in Table 2. Otherwise, the obtained raw data can be directly used instead of imputing missing data.

b. Removing overflow data. The amount of the data overflowing the routine evaluation scale in CSS2019 is extremely small, thus the overflow data can be removed from the raw data.

c. Evaluation scales consistency processing. This research will consistency process the other evaluation scales according to the 10-point system (1-10 scale), and the processing methods and results are shown in Table 3.

Table3. The consistent processed scales according to the 10-point system

NO.	The original scales in CSS2019	The consistent processed scales in this research	Index in Table2
1	1-Upper-class; 2-Upper middle; 3-Middle; 4-Lower middle; 5-Underclass	2-Underclass; 4-Lower middle; 6-Middle; 8-Upper middle; 10-Upper-class;	E_1, E_2, I_4
2	1-Income over spending; 2-Income and expenditure balance; 3-Income less than expenditure	3-Income less than expenditure; 6-Income and expenditure balance; 9-Income over spending	E_3
3	1-More serious; 2-Serious; 3-Less serious; 4-Nothing serious	1-More serious; 3-Serious; 6-Less serious; 9-Nothing serious	L_1, L_2, L_3, L_4
4	1-Very good (Strongly agree); 2-Good (Basically agreed); 3-Bad(Partially disagree); 4-Very bad (Strongly disagree)	1-Very bad (Strongly disagree); 4- Bad(Partially disagree); 7-Good (Basically agreed); 10-Very good (Strongly agree)	L_5, G_2, G_3, G_4, G_5, G_6, I_2, I_3

(2) Evaluation methods. Since the respondents who provided the survey data came from the same region and had their same concerns, the statistical histogram of the survey data of a certain index in the same region generally shows the characteristics of high in the middle and low at both ends, accordingly, it can be primarily concluded that the survey data of a certain index in the same region may obey normal distribution, *t*-distribution and log-normal distribution [39]. More importantly, it has been generally accepted that the human cognitions usually have the essence of fuzzy uncertainty, and the fuzzy membership function of normal distribution is the most suitable one to describe the human fuzzy cognitions [40-43]. In the large scale social survey, the respondents are often asked to provide accurate numbers (for example, any number in 1-10) to indicate their subjective cognitions for a certain evaluation object, and the accurate numbers sets are often strictly analyzed with mathematical statistics theory to draw some conclusions. Actually, the research methods on social survey data with rigorous statistical theory are not entirely reasonable, because the accurate numbers still represent the fuzziness and randomness of the respondents' cognitions and responses, instead, the theories and methods of uncertainty decision-making can be tried, for example, the fuzzy and stochastic multi-criteria decision-making methods [44-45].

Consequently, let $X_{ij}=\left\{x_{ij}^1,x_{ij}^2,\cdots,x_{ij}^q,\cdots,x_{ij}^n\right\}$ be the processed survey data collection of the j^{th} evaluation index of the study region $A_i\,(i=1,2,3)$ as defined in section 3.2, where $x_{ij}^q\in[1,10]$ is the evaluation score of the q^{th} $(q=1,2,\cdots,n)$ respondent and n is the total number of respondents of the j^{th} evaluation index and the study region A_i. This research makes the following assumptions:

***Assumption* 1**: The public overall cognitions X_{ij}^{Δ} on the j^{th} evaluation index of the study region A_i can be described by the membership function of normal distribution with expectation μ_{ij} and variance σ_{ij}^2, written as $X_{ij}^{\Delta}\sim N(\mu_{ij},\sigma_{ij}^2)$;

***Assumption* 2**: The survey data collection $X_{ij}=\left\{x_{ij}^1,x_{ij}^2,\cdots,x_{ij}^q,\cdots,x_{ij}^n\right\}$ provided by randomly selected n respondents can be regarded as a sample set of the overall distribution $X_{ij}^{\Delta}\sim N(\mu_{ij},\sigma_{ij}^2)$;

***Assumption* 3**: When there are enough samples ($n\geq 50$), the sample set $X_{ij}=\left\{x_{ij}^1,x_{ij}^2,\cdots,x_{ij}^q,\cdots,x_{ij}^n\right\}$ can be used to estimate the expectation μ_{ij} and variance σ_{ij}^2 of the overall distribution $X_{ij}^{\Delta}\sim N(\mu_{ij},\sigma_{ij}^2)$, written as $\hat{\mu}_{ij}$ and $\hat{\sigma}_{ij}^2$ respectively.

Based on the above assumptions, the survey data collection $X_{ij}=\left\{x_{ij}^1,x_{ij}^2,\cdots,x_{ij}^q,\cdots,x_{ij}^n\right\}$ can be

aggregated and approximately represented by normal distribution information $N(\hat{\mu}_{ij},\hat{\sigma}_{ij}^2)$. Maybe, $X_{ij} \sim N(\hat{\mu}_{ij},\hat{\sigma}_{ij}^2)$ cannot pass the strict normality test with statistical theory, but it doesn't matter, the further research of this paper is the PSG evaluation rather than strict statistical analysis, thus the above approximate distribution assumptions can do well. After that, the problem to evaluate the PSG has been in fact transformed into a multi-criteria large group decision-making problem under fuzzy and stochastic uncertainty environment in this paper.

In summary, the evaluation methods are designed as follows. Firstly, approximately analyze the normal distribution characteristics with the statistical histograms of the survey data collection, if there is a slight deviation, use the P-P graph or Q-Q graph method by SPSS to remove the outliers, or to adjust the outliers according to the principle of proximity; then, estimate the parameters of $X_{ij} \sim N(\hat{\mu}_{ij},\hat{\sigma}_{ij}^2)$ and aggregate the comprehensive evaluation information with normal distribution according to the index weights in Table 2. Finally, calculate the dominance values for evaluation objects [46] and construct their dominance matrix, by which, the comprehensive evaluation results of the PSG on YB conservation and development can be output based on the idea of PROMETHEE Ⅱ [47-49], the cause analysis and policy recommendations can be conducted accordingly. The framework of evaluation methods of the PSG on YB conservation and development is shown as Figure 3.

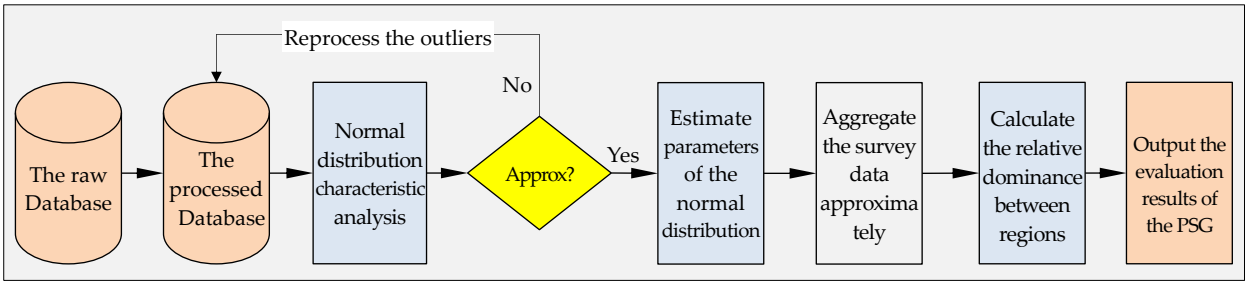

Figure3. The framework of evaluation methods of the PSG on YB conservation and development

In Fig.3, the parameters of normal distribution $N(\hat{\mu}_{ij},\hat{\sigma}_{ij}^2)$ can be estimated based on the point estimate method which has been widely accepted

$$\hat{\mu}_{ij} = \frac{1}{n_{ij}} \sum_{q=1}^{n_{ij}} x_{ij}^q \tag{1}$$

$$\hat{\sigma}_{ij} = \sqrt{\frac{1}{n_{ij}-1} \sum_{q=1}^{n_{ij}} (x_{ij}^q - \mu_{ij})^2} \tag{2}$$

According to equation (1)-(2), the density function of normal distribution $N(\hat{\mu}_{ij},\hat{\sigma}_{ij}^2)$ can be written as

$$f_i^{\,j}(x) = \frac{1}{\sqrt{2\pi}\hat{\sigma}_{ij}} e^{-(x-\hat{\mu}_{ij})^2/2\hat{\sigma}_{ij}^2} \tag{3}$$

Next, this research tries to use only one normal distribution to approximately aggregate all of the survey data on the PSG of the study region A_i, written as $f_i(x)$

$$f_i(x) = \sum_{j=1}^{N_j} w_{ij} f_i^{\,j}(x) \tag{4}$$

Because $f_i^{\,j}(x)$ is a normal distribution density function, $f_i(x)$ is also a normal distribution density function according to the linear property of normal distribution, then

$$f_i(x) = \frac{1}{\sqrt{2\pi}\hat{\sigma}_i} e^{-(x-\hat{\mu}_i)^2/2\hat{\sigma}_i^2} \tag{5}$$

Where: $\hat{\mu}_i = \sum_{j=1}^{N_j} w_{ij}\hat{\mu}_{ij}, \hat{\sigma}_i = \sqrt{\sum_{j=1}^{N_j} w_{ij}^2 \hat{\sigma}_{ij}^2}$; $W_i = \left(w_{i1}, w_{i2}, \cdots, w_{ij}, \cdots, w_{iN_j}\right)$ is the indices weight vector on the PSG of the study region A_i and $N_j = 5,5,6,5,4$ which has been given in Table 2.

This research tries to use dominance matrix method to comprehensively evaluate the PSG of the study regions on YB conservation and development. According to reference [50], the dominance between

any two continuous distributions $f_1(x), f_2(x)$ is $D_{f_1 \succ f_2}$, where $D_{f_1 \succ f_2} = \int_{-\infty}^{+\infty} \int_{-\infty}^{x_1} f_1(x_1) f_2(x_2) dx_2 dx_1$. Then the dominance value for any two evaluation objects described by normal distribution Z_i over $Z_{i'}$ can be written as follow

$$D_{Z_i \succ Z_{i'}} = D_{f_i(x) \succ f_{i'}(x)} = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\frac{\mu_i - \mu_{i'}}{\sqrt{\sigma_i^2 + \sigma_{i'}^2}}} e^{-t^2/2} dt = \int_{-\infty}^{\frac{\mu_i - \mu_{i'}}{\sqrt{\sigma_i^2 + \sigma_{i'}^2}}} \frac{1}{\sqrt{2\pi}} e^{-t^2/2} dt \tag{6}$$

In the same way, the dominance of $A_{i'}$ over A_i $(i, i' = 1, 2, 3)$ can be written as follow

$$D_{Z_{i'} \succ Z_i} = D_{f_{i'}(x) \succ f_i(x)} = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\frac{\mu_{i'} - \mu_i}{\sqrt{\sigma_i^2 + \sigma_{i'}^2}}} e^{-t^2/2} dt = \int_{-\infty}^{\frac{\mu_{i'} - \mu_i}{\sqrt{\sigma_i^2 + \sigma_{i'}^2}}} \frac{1}{\sqrt{2\pi}} e^{-t^2/2} dt \tag{7}$$

The dominance values of $D_{Z_i \succ Z_{i'}}, D_{Z_{i'} \succ Z_i}$ can be obtained by querying the standard normal distribution table, and they can be written as $d_{ii'}, d_{i'i}$. Accordingly, the dominance matrix of the PSG among m evaluation objects on YB conservation and development can be established as $D = \begin{bmatrix} d_{11} & d_{12} & \cdots & d_{1m} \\ d_{21} & d_{22} & \cdots & d_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ d_{mm} & d_{mm} & \cdots & d_{mm} \end{bmatrix}$, where m can be set according to the changes of the number of evaluation objects.

The degree of the PSG on YB conservation and development to which Z_i is superior and inferior to all other evaluation objects can be written as

$$\varphi_i^+ = \sum_{i'=1}^{m} d_{ii'}, \varphi_i^- = \sum_{i'=1}^{m} d_{i'i} \tag{8}$$

Therefore, the net dominance of Z_i can be calculated as

$$\varphi_i = \varphi_i^+ - \varphi_i^- = \sum_{i'=1}^{m} d_{ii'} - \sum_{i'=1}^{m} d_{i'i} \tag{9}$$

Finally, the net dominance of each evaluation object can be regard as its comprehensive evaluation result of the PSG on YB conservation and development, by which the further decision analysis and policy recommendations can be conducted.

3.4 Analysis of empirical results

First of all, the raw data of CSS2019 is preprocessed according to the evaluation index system (Table 2) and the methods designed in section 3.3, and their evaluation scales are unified to 10-point system. It should be noted that the index of "Other pollution (L4)" has been finally removed from the evaluation index system in this case, and the weight vector of the sub-index layer of Living environment (L) is finally updated as $W_l = (0.1651, 0.2701, 0.0774, 0.4875)$.

Secondly, the statistical histogram of each evaluation index of the study region A1, A2 and A3 can be drawn with the preprocessed data, by which, it can be approximately judged that each group of data may follow the normal distribution. And then, the expectation $\hat{\mu}$ and standard deviation $\hat{\sigma}$ of the normal distribution can be estimated according to equation (1)-(2). Due to the limited space, this paper takes Economic situations (E) in A1, A2 and A3 as examples to illustrate the above analysis process. The statistical histograms of its sub-index E1, E2, E3, E4 and E5 are shown as Figure 4, and their estimated parameters of normal distribution are listed in Table 4. Besides, the surveyed regions of the entire China in CSS2019 are taken as the study region A_C for comparative analysis.

The weight vector of the evaluation indices (E1-E5) to economic situations (E) has been given in Tab.2, $W_E = (0.0646, 0.0338, 0.1401, 0.2415, 0.5200)$. Then, according to equation (4)-(5) and the estimated parameters of normal distribution in Table 4, the normal distribution information of social survey data about economic situations (E) are approximately aggregated as shown in Table 5. Accordingly, the approximate normal distribution density function $f_{iE}(x)(i = 1, 2, 3, C)$ of the social survey data about economic situations (E) can be obtained according to equation (5).

After that, the dominance values of $D_{A_{iE} \succ A_{jE}}, D_{A_{jE} \succ A_{iE}}$ $(i = 1, 2, 3, C)$ can be obtained by querying the standard normal distribution table according to equation (6)-(7), thus the dominance matrix of the PSG about economic situations (E) among study region A_1, A_2, A_3 and A_C can be established as

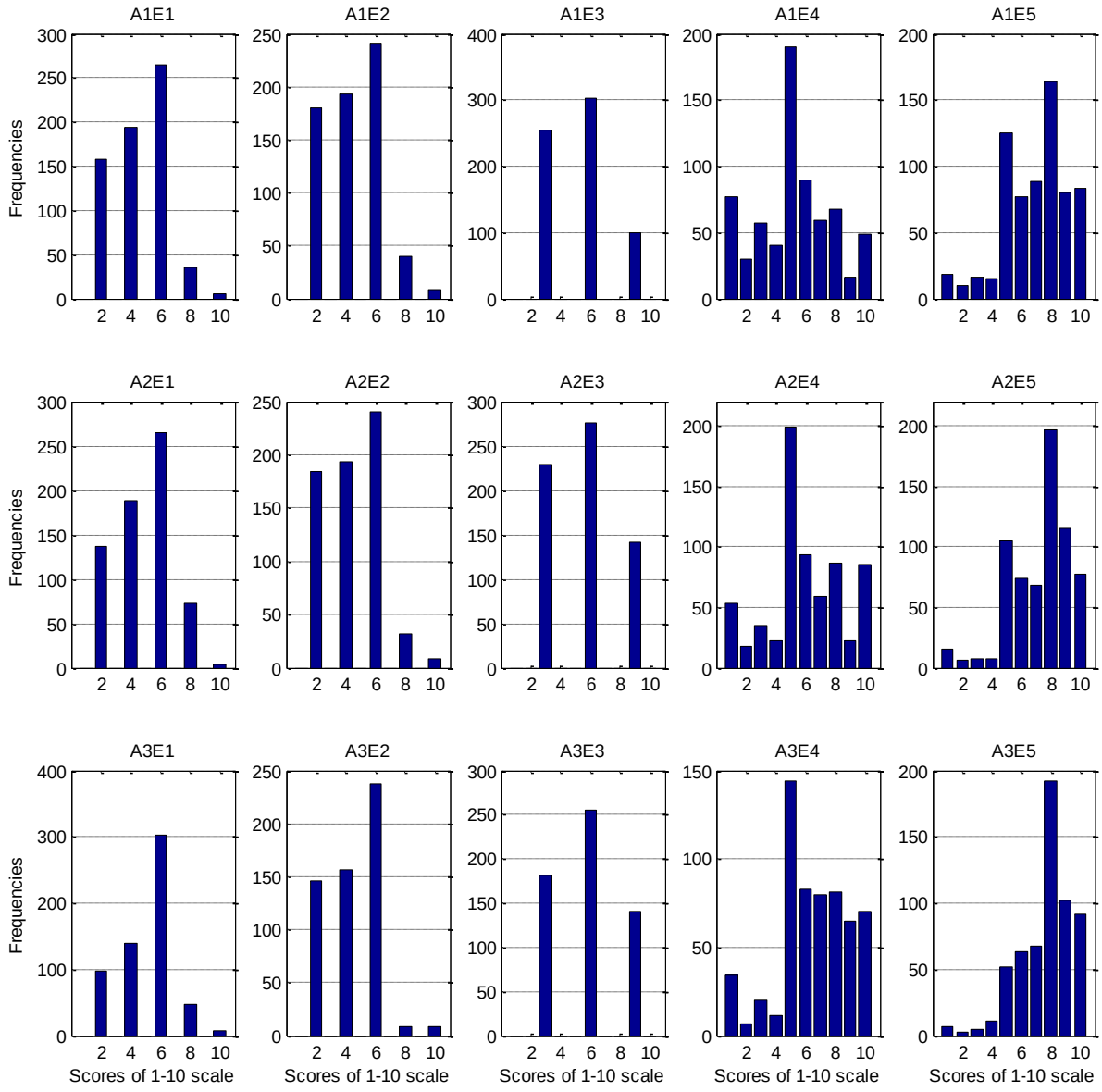

Figure4. The statistical histograms of the PSG on Economic situations (E) in A1, A2 and A3

Table4. The data characteristics and estimated parameters of normal distribution

	A1					**A2**					**A3**					**Ac**[*2]				
	E1	**E2**	**E3**	**E4**	**E5**	**E1**	**E2**	**E3**	**E4**	**E5**	**E1**	**E2**	**E3**	**E4**	**E5**	**E1**	**E2**	**E3**	**E4**	**E5**
ESS[*1]	657	661	655	676	676	665	657	646	672	672	595	590	577	595	595	10134	10036	9954	10282	10282
MIN	2	2	3	1	1	2	2	3	1	1	2	2	3	1	1	2	2	3	1	1
MODE	6	6	6	5	8	6	6	6	5	8	6	6	6	5	8	6	6	3	5	8
MAX	10	10	9	10	10	10	10	9	10	10	10	10	9	10	10	10	10	9	10	10
$\hat{\mu}$	4.58	4.50	5.29	5.25	6.97	4.86	4.44	5.59	5.93	7.29	5.09	4.68	5.78	6.49	7.66	4.68	4.40	5.48	5.72	7.09
$\hat{\sigma}^2$	1.83^2	1.92^2	2.09^2	2.48^2	2.14^2	1.91^2	1.90^2	2.24^2	2.49^2	2.00^2	1.80^2	1.95^2	2.23^2	2.36^2	1.81^2	1.85^2	1.99^2	2.30^2	2.46^2	2.23^2

[*1] Effective sample size; [*2] **Ac** represents the study region of the entire China in CSS2019.

Table5. The approximately aggregated parameters of normal distribution

A1		A2		A3		Ac	
$\hat{\mu}_{1E}$	$\hat{\sigma}^2_{1E}$	$\hat{\mu}_{2E}$	$\hat{\sigma}^2_{2E}$	$\hat{\mu}_{3E}$	$\hat{\sigma}^2_{3E}$	$\hat{\mu}_{CE}$	$\hat{\sigma}^2_{CE}$
6.08	1.304^2	6.47	1.249^2	6.85	1.152^2	6.29	1.545^2

$$D_E = \begin{bmatrix} 0.500 & 0.414 & 0.329 & 0.459 \\ 0.586 & 0.500 & 0.412 & 0.536 \\ 0.671 & 0.588 & 0.500 & 0.614 \\ 0.541 & 0.464 & 0.386 & 0.500 \end{bmatrix}$$

Finally, the net dominance of the PSG about economic situations (E) among study region A_1, A_2, A_3 and A_C can be calculated according to equation (8)-(9), and thus their comprehensive evaluation results can be regarded as follows: $\varphi_{1E} = -0.5956, \varphi_{2E} = 0.0062, \varphi_{3E} = 0.7475, \varphi_{CE} = -0.2181$. Accordingly, the PSG ranking results about economic situations (E) on YB conservation and development is $A_{3E} \succ A_{2E} \succ A_{CE} \succ A_{1E}$. That is, for the gain of sense on economic situations of individual and family, the PSG in Shandong is better than that in Henan, and both of them are above the overall level of China, however, the PSG of the middle and upper reaches of the Yellow River is at the bottom.

In the same way, the net dominances of the PSG about living environment (L), government public services (G), social civilizations (S), and individual self-fulfillments (I) among study region A_1, A_2, A_3 can be calculated according to equation (8)-(9), and their PSG ranking results are listed in Table 6. It can be seen from Table 6 that the PSG in Shandong is the best one of all factor dimensions, the PSG in Henan takes the second place (except the factor dimension of individual self-fulfillments (I)), and both of them are above the overall level of China, however, the PSG of the middle and upper reaches of the Yellow River is at the bottom (except the factor dimension of individual self-fulfillments (I)). Accordingly, the total PSG on YB conservation and development can be determined as $A_{1T} \prec A_C \prec A_{2T} \prec A_{3T}$, which are basically consistent with the actual economic and social situations of the Yellow River Basin.

In addition, the PSG about economic situations (E), living environment (L), government public services (G), social civilizations (S), and individual self-fulfillments (I) in each study region can be investigated with the same methods as above without consideration of their weights, and their ranking results are listed in Table 7.

Table6. The results ranking of the PSG on YB conservation and development

Factor dimensions	Weight	The study regons of the Yellow River basin						The study region of China		Results ranking
		A1		A2		A3		AC		
Economic situations (E)	0.4534	$\hat{\mu}_{1E}$	$\hat{\sigma}^2_{1E}$	$\hat{\mu}_{2E}$	$\hat{\sigma}^2_{2E}$	$\hat{\mu}_{3E}$	$\hat{\sigma}^2_{3E}$	$\hat{\mu}_{CE}$	$\hat{\sigma}^2_{CE}$	$A_{1E} \prec A_{CE} \prec A_{2E} \prec A_{3E}$
		6.08	1.304^2	6.47	1.249^2	6.85	1.152^2	6.29	1.545^2	
Living environment (L)	0.2059	$\hat{\mu}_{1L}$	$\hat{\sigma}^2_{1L}$	$\hat{\mu}_{2L}$	$\hat{\sigma}^2_{2L}$	$\hat{\mu}_{3L}$	$\hat{\sigma}^2_{3L}$	$\hat{\mu}_{CL}$	$\hat{\sigma}^2_{CL}$	$A_{1L} \prec A_{CL} \prec A_{2L} \prec A_{3L}$
		6.25	1.567^2	6.56	1.399^2	6.74	1.404^2	6.36	1.452^2	
Government public services (G)	0.1025	$\hat{\mu}_{1G}$	$\hat{\sigma}^2_{1G}$	$\hat{\mu}_{2G}$	$\hat{\sigma}^2_{2G}$	$\hat{\mu}_{3G}$	$\hat{\sigma}^2_{3G}$	$\hat{\mu}_{CG}$	$\hat{\sigma}^2_{CG}$	$A_{1G} \prec A_{CG} \prec A_{2G} \prec A_{3G}$
		6.93	1.207^2	7.17	1.158^2	7.71	1.036^2	7.08	1.126^2	
Social civilizations (S)	0.0433	$\hat{\mu}_{1S}$	$\hat{\sigma}^2_{1S}$	$\hat{\mu}_{2S}$	$\hat{\sigma}^2_{2S}$	$\hat{\mu}_{3S}$	$\hat{\sigma}^2_{3S}$	$\hat{\mu}_{CS}$	$\hat{\sigma}^2_{CS}$	$A_{1S} \prec A_{CS} \prec A_{2S} \prec A_{3S}$
		6.67	1.457^2	7.02	0.857^2	7.46	1.333^2	6.88	1.160^2	
Individual self-fulfillments (I)	0.1949	$\hat{\mu}_{1I}$	$\hat{\sigma}^2_{1I}$	$\hat{\mu}_{2I}$	$\hat{\sigma}^2_{2I}$	$\hat{\mu}_{3I}$	$\hat{\sigma}^2_{3I}$	$\hat{\mu}_{CI}$	$\hat{\sigma}^2_{CI}$	$A_{CI} \prec A_{2I} \prec A_{1I} \prec A_{3I}$
		6.42	2.081^2	6.34	2.181^2	6.62	2.184^2	6.29	1.364^2	
The total PSG on YRB conservation and development (T)		$\hat{\mu}_{1T}$	$\hat{\sigma}^2_{1T}$	$\hat{\mu}_{2T}$	$\hat{\sigma}^2_{2T}$	$\hat{\mu}_{3T}$	$\hat{\sigma}^2_{3T}$	$\hat{\mu}_C$	$\hat{\sigma}^2_C$	$A_{1T} \prec A_C \prec A_{2T} \prec A_{3T}$
		6.29	1.738^2	6.56	1.753^2	6.90	1.887^2	6.41	0.816^2	

Table7. The results ranking of the PSG in each study region of the Yellow River Basin

Study region	Factor dimensions										Results ranking
	Economic situations (E)		Living environment (L)		Government public services (G)		Social civilizations (S)		Individual self-fulfillments (I)		
A1	$\hat{\mu}_{1E}$	$\hat{\sigma}^2_{1E}$	$\hat{\mu}_{1L}$	$\hat{\sigma}^2_{1L}$	$\hat{\mu}_{1G}$	$\hat{\sigma}^2_{1G}$	$\hat{\mu}_{1S}$	$\hat{\sigma}^2_{1S}$	$\hat{\mu}_{1I}$	$\hat{\sigma}^2_{1I}$	$A_{1E} \prec A_{1L} \prec A_{1I} \prec A_{1S} \prec A_{1G}$
	6.08	1.304^2	6.25	1.567^2	6.93	1.207^2	6.67	1.457^2	6.42	2.081^2	
A2	$\hat{\mu}_{2E}$	$\hat{\sigma}^2_{2E}$	$\hat{\mu}_{2L}$	$\hat{\sigma}^2_{2L}$	$\hat{\mu}_{2G}$	$\hat{\sigma}^2_{2G}$	$\hat{\mu}_{2S}$	$\hat{\sigma}^2_{2S}$	$\hat{\mu}_{2I}$	$\hat{\sigma}^2_{2I}$	$A_{2I} \prec A_{2E} \prec A_{2L} \prec A_{2S} \prec A_{2G}$
	6.47	1.249^2	6.56	1.399^2	7.17	1.158^2	7.02	0.857^2	6.34	2.181^2	
A3	$\hat{\mu}_{3E}$	$\hat{\sigma}^2_{3E}$	$\hat{\mu}_{3L}$	$\hat{\sigma}^2_{3L}$	$\hat{\mu}_{3G}$	$\hat{\sigma}^2_{3G}$	$\hat{\mu}_{3S}$	$\hat{\sigma}^2_{3S}$	$\hat{\mu}_{3I}$	$\hat{\sigma}^2_{3I}$	$A_{3I} \prec A_{3L} \prec A_{3E} \prec A_{3S} \prec A_{3G}$
	6.85	1.152^2	6.74	1.404^2	7.71	1.036^2	7.46	1.333^2	6.62	2.184^2	

Some interesting conclusions can be drawn from Table 6 and Table 7. Firstly, the public in Yellow River Basin are generally satisfied with the government's public services, followed by the overall civilization of the society, it should attribute the achievements to the Chinese government's unremitting efforts in the functional transition of the governments and the construction of mental civilization for a long time, especially since the 18th CPC National Congress. Secondly, the public in the middle and upper reaches of the Yellow River (A1) are generally the most dissatisfied with their individual and family economic situations, and the PSG about economic situations (E) of Henan and Shandong are also in the middle and lower levels. This's because, the Yellow River Basin has a relatively concentrated poverty-stricken population in China, and it involves 5 of China's 14 contiguous poverty-stricken areas, which are mainly distributed in Henan and the upper and middle reaches of the Yellow River [51], thus the public there are very eager to improve their individual and family economic situations and live a good life. Fortunately, the poverty alleviation is one of the important contents of this Chinese major strategy for YB Conservation and Development, the PSG about economic situations will certainly be improved in the future. Thirdly, the PSG about living environment (L) of the three study regions in the whole Yellow River Basin are all in the middle and lower levels of their respective ranking lists. Since ancient times, the Yellow River has been both a "mother" river and a "devil" river, and the Chinese central and local governments have tried to harness and improve the Yellow River and gained lots of achievements, however, there are still many ecological and environmental problems affecting people's quality of life [9], and these problems are also included in this Chinese major strategy for YB Conservation and Development. Finally, the PSG about individual self-fulfillments (I) in Henan and Shandong are both at the bottom of their respective ranking lists, while it is at the middle level of their ranking list of the public in the middle and upper reaches of the Yellow River. The result suggests that the publc are generally dissatisfied with their individual self-efficiency, development opportunities and development capabilities, especially the people in Henan and Shandong, thus it should arouse the attentions of the local governments.

On the whole, the evaluation results of the PSG on Yellow River Basin conservation and development in this research are basically in line with the actual situations, and the evaluation results can also provide decision references for tieir further work of the local governments in Yellow River Basin. It is suggested that the local governments should conduct a deeper social investigations on the PSG within their area directed against their weaknesses, so as to obtain more detailed decision supports and formulate corresponding improvement countermeasures.

4. Conclusions

(1) The PSG was proposed as the most suitable benchmark and scale in this paper to measure the achievements of YB conservation and development, and the PSG on YB conservation and development has been specifically defined as the further subjective psychological welfare increment of the general public generated after their effectively obtaining material, health or psychological welfare effectively from the implementation process of this Chinese strategy. Accordingly, the logical principles and transmission mechanisms of the PSG and YB conservation and development has been constructed, and it was suggested that a good evaluation system of the PSG can provide better regulations and guidances for the sound development of the Yellow River Basin. Furthermore, it was suggested that a large-scale social survey should be carried out regularly and continuously to investigate the general feelings of a wider public in the Yellow River Basin, including the local ordinary residents, the policymakers in government, the media workers, the businessmen, the scholars and researchers, and the NGOs/NFOs/CBOs and so on.

(2) Taking the social survey data of CSS2019 released by CASS at the end of 2020 as the basis, this paper attempted to exam the PSG on YB conservation and development at the beginning of this Chinese strategy. An evaluation index system including 5 factor dimensions and 25 evaluation indices has been constructed, and the consistent processed methods of the raw data in CSS2019 has been developed. After that, the normal distribution of continuous distribution instead of discrete distribution has been used to describe the survey data, and the linear property of normal distribution and dominance matrix method are applied to make decision based on PROMETHEE Ⅱ. The human cognition usually have both the essences of fuzziness and randomness, and the fuzzy membership

function of normal distribution is the most suitable one to describe the human fuzzy cognition, therefore, the evaluation results with uncertain decision-making methods in this paper are more scientific and reasonable than that with rigorous statistical methods.

(3) The empirical results indicated that the PSG on the general economic and social development situations of the Yellow River Basin at the beginning of this Chinese strategy is basically equal to that of the overall level of the entire China, specifically, the PSG of Shandong and Henan are both above the overall level of China and the PSG of the middle and upper reaches of the Yellow River is lower than the national average. Therefore, governments at all levels in the middle and upper reach of the Yellow River are suggested to make more efforts to change their disadvantages in the next few years. Besides, Henan and Shandong are both suggested to develop a more active employment policy to improve the environment for entrepreneurship and employment, so as to promote the public to realize their individual value-pursuing, meanwhile, they should also continue to make greater efforts in improving people's livelihood and harnessing the ecological environment under the guidance of the national strategy of YB conservation and development.

(4) The further researches will be conducted in the following directions. The first is to continue to explore the driving mechanisms and spatio-temporal evolution models of the PSG on YB conservation and development, based on the panel data of social surveys in the past and years to come; the second is to conduct more detailed and micro-region social survey investigations on the basis of macro social survey and its comprehensive evaluation results, so as to provide more accurate decision-making suggestions for local governments; The third is to introduce and develop more scientific and reasonable evaluation methods from the perspective of multidisciplinary integration, uncertainty theory, Big Data analysis techniques, online public sentiment analysis methods and behavioral economics theory are all on the list of further attempts.

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